ATTACHMENT 5

Updated Response to Comment 15 of the USEPA January 30, 2012 Request for Information (Plan of Operation and Table 1)

Curis Resources (Arizona) Inc.
In-Situ Copper Recovery Phase 1 Facility Operations Plan

1. INTRODUCTION

This document provides a description of monitoring, control, and reporting requirements associated with the operation of the Florence Copper Project (FCP) in-situ copper recovery (ISCR) Phase 1 facilities in compliance with an Underground Injection Control (UIC) Permit. The methods and procedures described in this Operations Plan incorporate the detailed provisions contained in Attachments H, K, O, and P of the application that Curis Resources (Arizona) Inc. (Curis Arizona) submitted to the United States Environmental Protection Agency (USEPA) on March 31, 2011 to transfer, with modifications of UIC Permit AZ396000001 (UIC Application). The injection and recovery system will employ devices for metering flow and pressure, and for manually or automatically shutting down flow when alarm conditions occur. The metering devices will be monitored in a central control room and will provide sufficient information to allow the operator to maintain hydraulic control on a daily basis. Within the control room, the operator will have direct access to the necessary controls for shutting down the injection and extraction systems in response to unanticipated conditions.

Table 1, *ISCR Phase 1 Facility Operations Plan (Monitoring and Response Requirements)* provides a summary of methods and procedures related to Phase 1 (Production Test Facility [PTF]) operations. The table identifies major components of the ISCR process; devices by which the components are to be monitored; the operating conditions to be monitored; possible causes of those conditions; immediate responses required if conditions exceed specified limits; and required follow-up actions. The monitoring devices will be electronically linked to the facility control room in order to provide a continuous assessment of conditions in the ISCR area, the pipeline corridor, and process area.

2. OPERATIONS

2.1 Pre-Operational Review

Before commencing ISCR operations, operations personnel will conduct a pre-operational review of all equipment, monitoring devices, and procedures to ensure that the operations comply with the following permit conditions.

1. Mechanical integrity tests (Part I and Part II) have been conducted on all ISCR wells in the ISCR well field, and all wells have passed the tests.
2. All wells have been completed such that they will not inject solutions within the uppermost 40 feet of the oxide zone (injection exclusion zone).
3. All coreholes and non-Class III wells located within 500 feet of the PTF well block have been abandoned in accordance with the approved Plugging and Abandonment Plan.
4. Allowable injection pressure set not to exceed 0.65 pounds per square inch per foot (psi/ft) for each injection well.
5. Fresh groundwater has been injected, as needed, to assess the hydraulics of the injection and recovery patterns and to confirm that all monitoring devices and controls are in working order.

2.2 Injection System and Monitoring Devices

The injection system consists of individual injection wells, pumps, manifolds, piping, flow meters, and related controls. Manifolds will be used in Phase 1 to distribute lixiviant to injection wells and to collect pregnant leach solution (PLS) from recovery wells.

2.2.1 Injection Pressures

The proposed Class III injection wells may be operated in one of two modes: pressurized at the well head or under atmospheric well head pressures.

To ensure that injection pressures do not induce additional fracturing of the oxide zone, the UIC Permit established a fracture gradient limit of 0.65 psi/ft. Maximum injection pressures are determined by multiplying the fracture gradient limit (0.65 psi/ft) by the depth from the top of well casing to the top of the injection interval. This method of calculating maximum injection pressures reflects the pressure generated by the weight of the column of raffinate and an additional pressure applied by mechanical means to achieve the maximum allowable injection pressure at depth.

2.2.2 Injection Monitoring and Controls

Mechanical controls and monitoring devices incorporated into the injection system include:

- a pressure gauge at each injection manifold with set points;
- a flow meter at each injection manifold for measuring flow rates (gallons per minute [gpm]);
- a totalizing flow meter for measuring cumulative flow (gallons) into each injection manifold;
- an isolation valve at each injection well;
- a flow meter at each injection well for measuring flow rates (gpm); and
- a valve at each injection well for controlling flow.

Operators will use the gauges and meters at each injection manifold as devices for monitoring injection pressures and flows on a manifold-by-manifold basis. Allowable injection pressure will be calculated for each injection well. Actual pressures measured at each manifold will be compared to the maximum allowable pressure(s) for the well with the lowest allowable pressure, and will be adjusted as necessary to ensure injection pressures are within calculated allowable limits.

Every 24 hours, the totalized flows from all of the injection manifolds will be summed and compared to the summed totalized flows from all of the manifolds from recovery wells, hydraulic control (HC) wells, and injection and recovery zone (IRZ) restoration wells. If the summed total flow out of the IRZ exceeds the total flow into the IRZ, hydraulic control is confirmed. If the summed total flow out of the IRZ does not exceed the total flow into the IRZ, adjustments to recovery and/or injection flow rates will be made accordingly to restore hydraulic control.

Reduced flow in an injection well may be due to changes in formation characteristics or clogging of the formation or the well screens. A sudden increase in flow may indicate a break/failure of the well casing. If a casing breach is believed to have occurred, the operator will shut down that well by closing the well head isolation valve and will conduct relevant inspections. Inspections and related reporting will be conducted in accordance with Plans for Well Failures (Attachment O).

The injection and recovery systems will be connected to one or more tank farms in the ISCR area. The tank farms will include tanks fitted with a high-level alarm and level indicators. Both alarm and level indicator signals will be routed to the control room. An alarm will actuate if either a line fails or the tank high level is exceeded. The feed pump to the tank will be disabled automatically. Spilled solutions will be captured in a lined collection sump able to contain 110 percent of the volume of the tank and line. The spilled volume will be pumped back into the circuit for reuse.

Solutions pumped through pipelines located in pipeline channels between the ISCR area and the process area will be metered for flow and pressure. An electronic monitoring system will alarm if a pump fails, flow is interrupted, or flow is not in logical mode when a pump is activated. Loss of pressure or pressure exceeding a high setting will cause the pump to automatically shut down. In the event of such an occurrence, the plant operator will inspect the system. A broken line will be repaired within 72 hours and spilled solutions captured in spill control sumps in the lined channels will be pumped back into the process systems or to the water impoundment.

2.2.2.1 Recovery System Monitoring and Controls

The recovery system is similar to the injection system. It is comprised of individual recovery wells, pumps, recovery manifolds, piping, and related meters and controls, and includes:

- a continuous reading flow meter (gpm) at each recovery manifold;
- a totalizing flow meter (gallons) at each recovery manifold;
- an isolation valve at each recovery well;
- a flow meter at each recovery well; and
- a pressure transducer within perimeter and selected recovery wells for measuring head/water elevation within an IRZ (to assess hydraulic control).

The flow meters on the recovery manifolds will allow the operators to monitor recovery flow rates and use the data to compare against injection flow rates as described above. As necessary, recovery flow can be adjusted in the manifolds to ensure that flow out of the operational unit exceeds the flow of lixiviant and any other injectate into the operational unit. Inspections and related reporting will be conducted in accordance with Plans for Well Failures (Attachment O.)

2.2.2.2 Hydraulic Control

Hydraulic control must be maintained from the time that lixiviant injection begins until the groundwater quality in the IRZ has been restored to a quality that meets closure criteria in the Aquifer Protection Permit (APP) and the UIC Permit.

Hydraulic control is defined as a condition involving an inward groundwater gradient. It is maintained by pumping more solution from the IRZ than is injected into the IRZ, and is used to prevent in-situ solutions from migrating beyond the IRZ.

In-line flow meters will be used to monitor and verify that the volume of PLS pumped from recovery wells exceeds the amount of lixiviant injected to confirm hydraulic control. In addition, the presence of an inward hydraulic control will be monitored on a daily basis by comparing water levels in paired wells along the perimeter of the IRZ. Hydraulic control is confirmed when the water level in the outer well is higher than the water level in the inner well of each well pair.

3. OPERATIONAL MONITORING

Table 1 (attached) summarizes operational monitoring methods and procedures that will be used during Phase 1 (PTF) operations. Table 1 is designed to provide for the identification and correction of any problem related to the storage or flow of ISCR solutions before the solutions reach surface soils, the vadose zone, or groundwater outside the IRZ. The monitoring methods and procedures are also designed to monitor and maintain hydraulic control and thereby prevent ISCR solutions from migrating beyond the IRZ. Table 1 is not intended to cover the sampling and analysis of groundwater or ISCR solutions because of the complexity of the required equipment and procedures. However, references are provided in Section 1 for all related sampling and analysis requirements.

3.1 Emergency Response/Contingency Plan Requirements Emergency Conditions

The following conditions will cause activation of the contingency plan.

1. Spills of sulfuric acid, raffinate, or PLS outside containment structures that are in excess of the reportable quantities set forth in 40 CFR 302 et seq.
2. Loss of hydraulic control within an operational unit for more than 72 consecutive hours. For purpose of this requirement, loss of hydraulic control means that the amount of fluids injected during a 72-hour period exceeds the amount of fluid recovered during the same 72-hour period, and/or that the average head reading for any observation pair for a 72-hour period indicates a flat or outward gradient.
3. Failure of transducers in any observation pair for more than 72 hours.

3.2 Emergency Response Actions

The occurrence of any of the conditions described above will result in:

1. The activation of the notification procedures set forth in the APP.
2. Immediate containment of the spilled material, return of collected liquids to the process or to the evaporation ponds, disposal of contaminated soils in the water impoundment(s), and disposal of other debris in approved off-site facilities.
3. Immediate cessation of injection until such time that hydraulic control has been established and recovery wells have operated a sufficiently long period of time to compensate for the amount of fluid that was injected in excess of the amount recovered during the 72-hour period.

4. RECORDKEEPING AND REPORTING

Operational reporting will be conducted at two levels: daily and quarterly. Curis Arizona operators will complete a daily operations log that includes each of the daily monitoring requirements and calculations described above, and other entries related to the injection and recovery process. These logs will be maintained on site and be available for inspection for a period of two years. Quarterly monitoring reports will be submitted to the Arizona Department of Environmental Quality (ADEQ), and will include summaries of pertinent data from the daily operations log, as well as water quality sampling results for the point-of-compliance (POC) wells. Copies of the quarterly reports will be maintained on site until commencement of the post-closure period.

4.1 Daily Operations Log

The daily operations log will include the following:

- Daily cumulative flow rates for each of the injection and recovery manifolds.
- Daily cumulative total flow rates for the all of in the injection and recovery manifolds combined.
- Daily average water level readings for each perimeter/recovery well pair.
- List of injection and recovery wells shut down in response to alarm conditions, and actions taken to correct the alarm conditions noted. This information will include well identification, shut down time, and estimate of excess injection flow occurring prior to shut down.

4.2 Quarterly Monitoring Report

Quarterly monitoring reports will be submitted to ADEQ and USEPA within 45 days following the end of each calendar quarter. The quarterly reports will include:

- A table showing POC monitoring well analytical results and alert levels with a narrative summary of those results.
- Results of monthly analysis of organics in raffinate.
- A table and graphs showing daily average head in the paired perimeter and observation wells.
- A table and graph showing daily cumulative injection and recovery flow in each active production unit over the reporting period.
- Results of monitoring required by 40 CFR 146.33(b)(i) whenever the injection fluid is modified to the extent that previously reported analyses are incorrect and incomplete.
- Results of mechanical integrity testing completed during the reporting period.
- A map showing current operational unit status.
- A list of wells and coreholes abandoned during the reporting period, and a list of wells and coreholes to be abandoned during the next reporting period.

Table 1. ISCR Phase 1 Facility Operations Plan (Monitoring and Reponse Requirements)

		Component	Monitoring Device	Condition	Possible Cause*	Response	Follow-up Action
System Monitoring and Control Devices	Injection System	Injection Manifold and Pipeline	Pressure Gage or Transducer with upper and lower set points	Pressure exceeds upper setting	Improper pump setting, clogged screens, reduced formation permeability, obstructed well or equipment.	Alarm in control room, stop flow at injection manifold	Restart injection at lower flow rates.
				Pressure below lower setting	Line break, casing or screen breach.	Alarm in control room, stop flow at injection manifold	Repair system before restarting flow to injection manifold.
			Flow Meter	Flow rate too high	Improper pump setting, line break, injection well short circuit.	Alarm in control room, stop or reduce flow at injection manifold	Inspect/repair injection system, increase flow rates in adjoining recovery monifolds as necessary.
				Flow rate too low	Improper pump setting, clogged screens, reduced formation permeability, obstructed well or equipment.	Alarm in control room, reduce flow rates in adjoining recovery manifolds	Inspect/repair system, adjust injection flow rate as necessary.
			Totalizing Flow Meter	Daily total flow: Total in > total out	Loss of hydraulic control.	Reduce injection flow rate or increase recovery flow rate	Follow Part II.H.1 of UIC Permit and related reporting and record-keeping requirements.
		Injection Well Head	Flow Meter	No flow	Power loss, line break, instrument failure.	Reduce recovery rate in adjacent wells	Repair system, adjust flow rates as necessary.
				Flow rate too high	Improper pump setting, injection well short circuit, damaged well casing or equipment.	Reduce injection flow rate as necessary	Inspect/repair injection system.
				Flow rate too low	Improper pump setting, reduced formation permeability, obstructed well or equipment.	Reduce flow rates in adjoining recovery manifolds	Inspect/repair system, adjust injection flow rate as necessary.
	Recovery System	Recovery Manifold and Pipeline	Flow Meter	Flow rate too high	Improper pump setting.	Reduce recovery manifold flow rates as necessary	Inspect/repair system, reduce recovery flow rate as necessary.
				Flow rate too low	Improper pump setting, reduced formation permeability, obstructed well or equipment.	Increase pump rate	Inspect/repair system, reduce injection flow rate in adjacent manifolds as necessary.
			Totalizing Flow Meter	Daily total flow: Total in > total out	Loss of hydraulic control.	Reduce injection flow rate or increase recovery flow rate as necessary	Follow Part II.H.1 of UIC Permitand related reporting and record-keeping requirements.
		Recovery Well Head	Flow Meter	No flow	Power loss, intrument failure.	Alarm in control room, stop injection in adjoining injection wells	Repair system before restarting injection.
			Pressure Transducer (in selected wells only)	Fluid level too high	Improper pump setting, short circuit in adjacent injection wells.	Alarm in control room, adjust pump setting, inspect well, reduce injection in adjoining wells as necessary	Inspect/repair recovery well and adjacent injection wells as necessary.
				Fluid level too low	Improper pump setting, clogged screen, reduced formation permeability.	Alarm in control room, automatic shut-off of pump	Evaluate formation, restart well at lower flow rate if necessary.
	ISCR Area Tanks	Raffinate/Lixiviant Tanks	Level Indicators	Fluid level too high	If in production mode, insufficient flow to injection wells or insufficient raffinate bleed to water impoundment. If in recirculation mode, too much flow from PLS tanks.	Alarm in control room, automatic shut-off of pumps at raffinate tanks	Inspect/repair injection system, adjust pump settings at raffinate tank.
				Fluid level too low	If in production mode, flow too high to injection manifolds or too much raffinate bleed to water impoundment. If in recirculation mode, insufficient flow from PLS tanks.	Alarm in control room, automatic shut-off of injection pumps	Inspect/repair injection/raffinate system, adjust pumps at raffinate tank.
		PLS Tanks	Level Indicators	Fluid level too high	Recovery rate too high, or flow to SX/EW too low if in production mode, or flow to raffinate tank too low if in recirulation mode.	Alarm in control room, automatic shut-off of recovery and injection wells	Inspect/repair injection system, adjust pumps to PLS pond and injection manifolds.
				Fluid level too low	Recovery rate too low or flow to SX/EW too high if in production mode, or flow to raffinate tank too high if in recirculation mode.	Alarm in control room, automatic shut-off of injection wells	Inspect/repair injection/recovery system; inspect/repair lines to raffinate tanks.

Table 1. ISCR Phase 1 Facility Operations Plan (Monitoring and Reponse Requirements)

		Component	Monitoring Device	Condition	Possible Cause*	Response	Follow-up Action
System Monitoring and Control Devices (continued)	Beneficiation Area Tanks	Raffinate/Lixiviant Tanks	Level Indicators	Fluid level too high	If in production mode, insufficient flow to injection wells or insufficient raffinate bleed to water impoundment. If in recirculation mode, too much flow from PLS tanks	Alarm in control room, automatic shut-off of pumps at raffinate tanks	Inspect/repair injection system, adjust pump settings at raffinate tank.
				Fluid level too low	If in production mode, flow too high to injection manifolds or too much raffinate bleed to water impoundment. If in recirculation mode, insufficient flow from PLS tanks.	Alarm in control room, automatic shut-off of injection pumps	Inspect/repair injection/raffinate system, adjust pumps at raffinate tank.
		PLS Tanks	Level Indicators	Fluid level too high	Recovery rate too high, or flow to SX/EW too low if in production mode, or flow to raffinate tank too low if in recirulation mode.	Alarm in control room, automatic shut-off of recovery and injection wells	Inspect/repair injection system, adjust pumps to PLS pond and injection manifolds.
				Fluid level too low	Recovery rate too low or flow to SX/EW too high if in production mode, or flow to raffinate tank too high if in recirculation mode.	Alarm in control room, automatic shut-off of injection wells	Inspect/repair injection/recovery system; inspect/repair lines to raffinate tanks.
	Pipeline Corridor	Sumps	Liquid Detectors	Liquid present	Precipitation or leak.	Alarm in control room. If not raining, arm immediate shut-off of associated pumps.	Assess liquid; return liquid to plant or water impoundment; evaluate and repair pipeline if needed.
	Runoff Pond	Sump	Liquid Level Indicator	Liquid accumulating in sump	Precipitation, leak, spill, wash down.	Alarm in control room; determine nature of liquid. Pump to PLS, raffinate tanks, or neutralizing unit/water impoundment depending on volume and source of liquid.	Inspect sump to confirm that accumulating liquids are being being removed.
	Water Impoundment	Leak Collection and Removal System (LCRS)	Conductivity probe	Presence of liquid in sump above pump-down level	Leak in upper (primary) liner.	Measure and record volume of liquid removed from LCRS sump, determine if ALR or RLL is exceeded.	If ALR or RLL is exceeded, follow APP contingency plan and related reporting and record-keeping requirements.
External Monitoring		Paired Recovery/Observation Wells	Pressure Transducer	Average daily head in recovery well > average daily head in observation well	Loss of hydraulic control.	Increase recovery flow rate or decrease injection flow rate as necessary	Follow Part II.H.1 of UIC Permit and related reporting and record-keeping requirements.

*Faulty monitoring devices will be evaluated as a possible cause of each listed condition.